

*Instruction Manual*  
RS-232

**MARTEL**  
ELECTRONICS

**306 Datalogger**

**THERMOMETER**

CE

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## I. Introduction:

This instrument is a digital thermometer for use with any K-type thermocouple as temperature sensor. Temperature indication follows National Bureau of Standards and IEC584 temperature/voltage table for K-type thermocouples. Its internal memory can store up to 16,312 records.(See Note 1 below.) An RS232 interface provides bi-directional communication with a PC.

## II. Specifications:

**Numerical Display:** 4 digital Liquid Crystal Display

**Measurement Range:** -200°C ~ 1370°C   -328°F ~ 2498°F

**Resolution:** -200°C~ 200°C: 0.1°C; 200°C ~1370°C: 1°C  
-200°F~ 200°F: 0.1°F; else 1°F

**Input Protection at Thermocouple Input:** 60V DC, or 24Vrms AC

**Environmental:**

- Operating Temperature and Humidity: 0°C ~50°C (32°F ~ 122°F) ; 0 ~ 80% RH
- Storage Temperature and Humidity: -10°C to 60°C (14°F ~ 140°F); 0 ~ 80% RH
- Altitude up to 2000 meters.

**Accuracy:** at ( 23 ± 5°C )

| Range           | Accuracy              |
|-----------------|-----------------------|
| -200°C ~ 200°C  | ±(0.2% reading + 1°C) |
| 200°C ~ 400°C   | ±(0.5% reading + 1°C) |
| 400°C~1370°C    | ±(0.2% reading + 1°C) |
| -328°F ~ -200°F | ±(0.5% reading + 2°F) |
| -200°F ~ 200°F  | ±(0.2% reading + 2°F) |
| 200°F ~ 2498°F  | ±(0.3% reading + 2°F) |

**Temperature Coefficient:**

For ambient temperatures from 0°C ~ 18°C and 28°C ~ 50°C, for each °C ambient below 18°C or above 28°C add the following tolerance into the accuracy spec.

0.01% of reading + 0.03°C  
(0.01% of reading + 0.06°F )



**Note:**

The basic accuracy specification does not include the error of the probe. Please refer to the probe accuracy specification for additional details.

**Sample Rate:** 1.25 times per second

**Dimensions (LxWxH):** 7.2"x2.5"x1.1" (184x64x30 mm)

**Weight:** 7.4 oz. (210g); approximate

**Accessories:** K-Type Bead Probe, Battery, Carrying Case, Instruction Manual, Software Package (Program and RS232 Connection Cable)

**Power Requirement:** 9 Volt Battery

**Battery Life:** Approx. 100hrs with alkaline battery

**AC Adapter:** 9VDC ±15% 100mA

**Plug Diameter:** 3.5mmx1.35mm

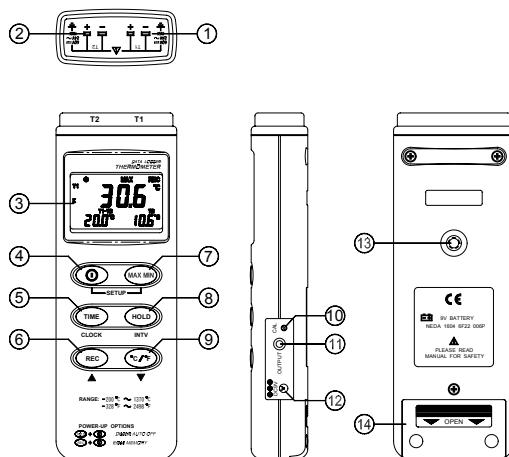
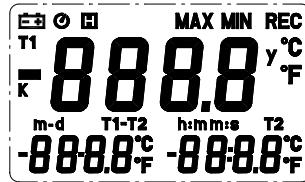
**Option :** AC Adapter

**Note1:**

Each time you press the "RECORD" button to start recording data and press it again to stop recording, a new data set is stored in memory. As many additional data sets as you want may be added into memory until it is full.

### III. Symbol Definition and Button Location:

- : This indicates that a negative temperature is sensed.
- °C°F** : Centigrade and Fahrenheit indication.
- K** : Thermocouple Type Indication
- MAX** : The Maximum value is being displayed
- MIN** : The Minimum value is being displayed
- ⌚** : This indicates auto power off is enabled.
- H** : This indicates that the display data is being held.
- m-d** : Indicates the value below is month and day
- h:m** : Indicates the value below is hour and minute
- m:s** : Indicates the value below is minute and second
- y** : Indicates year is displayed in the main window.
- ±** : The battery voltage is low. The battery should be replaced.
- REC** : This indicates that the tester is recording. If it blinks, it indicates the memory is full.



#### Button Location:

- ① K type temperature sensor T1 input connector
- ② K type temperature sensor T2 input connector
- ③ LCD display
- ④ ON/OFF button
- ⑤ Time display button
- ⑥ Record button
- ⑦ MAX MIN function control button
- ⑧ HOLD button
- ⑨ °C, °F control button
- ⑩ Offset calibration screw
- ⑪ Digital output connector
- ⑫ AC power adapter connector
- ⑬ Tripod connector
- ⑭ Battery cabinet cover

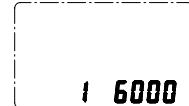
## IV. Operating Instructions:

### 4.1 Power-Up

Press the power button to turn the thermometer ON or OFF.

When powered on, the LCD will show how much memory space is available to use.

**For example:** It indicates that there are 16,000 records available in memory.



### 4.2 Connecting the Thermocouples

Plug the thermocouple into the input connectors.

### 4.3 Selecting the Temperature Scale

When the meter is first powered on, the default scale setting is set at Celsius (°C) scale. The scale may be changed to Fahrenheit (°F) by pressing the “°C/F” button. Press it again to revert to Celsius. When you power on, the scale setting will be the same as that when you last powered off.

### 4.4 Data-Hold Operation

The present reading may be held and kept on the display by pressing the “HOLD” button. When the held data is no longer needed, release the data-hold operation by pressing the “HOLD” button again.

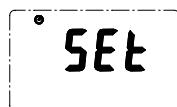
When the meter is in the Data Hold mode, the “TIME”, “MAX/MIN” and “°C/F” buttons are disabled, and will respond with two beeps when pressed.

### 4.5 DataLogger:

Pressing the “REC” button will start recording. Pressing it again will stop recording. To clear the memory, power off the meter, then press and hold the “REC” button while you press and hold the power button for at least 2 seconds. Release all buttons and the LCD will show “CLR” indicating that the memory has been cleared.



### 4.6 Clock Setup:

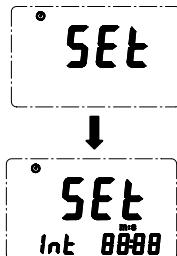


1. Press and hold the “MAX MIN” button and then power on the meter:

2. Press “TIME”(clock):

3. Press “REC” or “°C/F” to increase or decrease the number. Press the “TIME”(clock) button to adjust the next item. The adjustment order is year→month→day→hour→minute. When finished, press the “TIME” (clock) button to save your adjustments. If you want to abort the setup process, press the power button to cancel.

#### 4.7 Recording Interval Setup :



1. Press and hold “MAX MIN” button and then power on the meter;
2. Press “HOLD” (INTV)
3. Press “REC” or “°C/°F” to increase or decrease the number. Press the “HOLD” (INTV) button to adjust next item, then press the “HOLD” (INTV) to save your changes. If you want to abort the setup process, press the power button to cancel.

#### 4.8 Time Operation:

Pressing the “TIME” button will display time. The year is displayed at the top of the LCD, month and day are displayed on the bottom left of the display, and the hour and minute on the bottom right. Pressing the “TIME” button or any other button will exit this mode. This operation will not interrupt the recording and MAX/MIN operation.

#### 4.9 MAX/MIN Operation:

Pressing the “MAX/MIN” button enters the MAX/MIN mode. Under this mode the maximum and minimum values are kept in memory simultaneously and updated with every new data sample. When the MAX symbol is displayed, the Maximum value is displayed. Pressing the “MAX/MIN” button again displays both MIN symbol and the minimum reading. Pressing the “MAX/MIN” button again causes both MAX and MIN to blink together, which indicates that all these data is updated in the memory and the reading is the present temperature. Repeatedly pressing the “MAX/MIN” button cycles the display mode among these options. In the MAX/MIN mode the “°C/°F” button is disabled, and will respond with two beeps. To exit the MAX/MIN mode, press and hold “MAX/MIN” for two seconds.

#### 4.10 Auto Power Off:

By default, when the meter is powered on, it is in the auto power off mode. The meter will power itself off after 30 minutes if no key operation, no RS232 communications, and no recording occurs. To disable the auto power off feature, press and hold the “HOLD” button while powering on the meter. Two successive beeps indicate that auto power off is disabled and the  will not show up.

#### 4.11 Low Battery Condition

When the battery voltage below that for proper operation, the  symbol will be displayed. Replace the battery.

#### 4.12 Calibration Point:

| input   | Adjust VR | tolerance |
|---------|-----------|-----------|
| 0 °C    | VR1       | ± 0.1 °C  |
| 190 °C  | VR2       | ± 0.1 °C  |
| 1000 °C | VR3       | ± 1 °C    |
| 1900 °F | VR4       | ± 1 °F    |

#### P.S

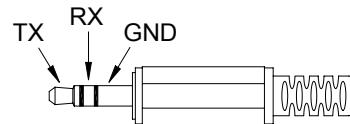
Normally, performing offset Calibration with thermal stabled ice water through VR1 will give a very good calibration result.

#### 4.13 Digital Output:

The Digital Output is a 9600bps N 81 serial interface.

The RX is a 5V normal high input port.

The TX is a 5V normal high output port.



The command of Digital Output is list below:

| RS232 command | Function                       | Remarks                |
|---------------|--------------------------------|------------------------|
| K(ASC 4BH)    | Ask for model No.              | Return 4 bytes         |
| A(ASC 41H)    | Inquire all encoded data       | Return encoded 10 byte |
| H(ASC 48H)    | Hold button                    |                        |
| M(ASC 4DH)    | MAX/MIN button                 |                        |
| N(ASC 4EH)    | Exit MAX/MIN mode              |                        |
| T(ASC 52H)    | TIME button                    |                        |
| C(ASC 43H)    | C/F button                     |                        |
| U(ASC 55H)    | Dump all memory of thermometer | return 32768 bytes     |
| P(ASC 50H)    | Load recorded data             |                        |

- **Command K:**

Return 4 bytes. For example, when sending command "K" to the meter, it will return "3","0","6", ASCII(13) .

- **Command U:**

Return 32,768 bytes .

- **Command P:**

Instead of returning all 32,768 bytes, only recorded data is returned .

- **Command H:**

Equivalent to pushing the **HOLD** button and no message is returned.

- **Command M:**

Equivalent to pushing the **MAX/MIN** button and no message is returned.

- **Command N:**

Equivalent to pushing and holding the **MAX/MIN** button for two seconds to exit MAX/MIN mode.

- **Command T:**

Equivalent to pushing the **TIME** button and no message is returned.

- **Command C:**

Equivalent to pushing the **°C/°F** button and no message is returned.

- **Command A:**

**1<sup>st</sup> BYTE:**

The first byte is the start byte , its value is 2.

**2<sup>nd</sup> BYTE:**

|      |         |      |      |      |         |      |      |
|------|---------|------|------|------|---------|------|------|
| bit7 | bit6    | bit5 | bit4 | bit3 | bit2    | bit1 | bit0 |
| C/F  | Low Bat | Hold |      | TIME | MAX/MIN | REC  |      |

**bit 0:** 1→recording mode, 0→not recording

**bit 2 bit 1**

|   |   |   |
|---|---|---|
| 0 | 0 | →normal mode                            |
| 0 | 1 | →MAXIMUM mode                           |
| 1 | 0 | →MINIMUM mode                           |
| 1 | 1 | →calculate MAX/MIN in background mode . |

**bit3:** 1→Indicates the LCD is displaying time.

**bit4:** not used

**bit5:** 1→ HOLD, 0→not HOLD

**bit6:** 1→LOW BATTERY , 0→BATTERY NORMAL

**bit7:** 1→°C 0→°F

**3<sup>th</sup> BYTE:**

| bit7           | bit6        | bit5       | bit4 | bit3 | bit2       | bit1 | bit0 |
|----------------|-------------|------------|------|------|------------|------|------|
| Auto Power Off | memory full | resolution | sign | OL   | resolution | sign | OL   |

**bit0:** 1→T1 is OL, 0→not OL

**bit1:** 1→T1 value is minus, 0→T1 value is plus.

**bit2:** 1→4<sup>th</sup> byte and 5<sup>th</sup> byte represent ##### , 0→4<sup>th</sup> byte and 5<sup>th</sup> byte represent ####.#

**bit3:** 1→T2 is OL, 0→not OL

**bit4:** 1→T2 value is minus, 0→T2 value is plus.

**bit5:** 1→8<sup>th</sup> byte and 9<sup>th</sup> byte represent ##### , 0→8<sup>th</sup> byte and 9<sup>th</sup> byte represent ####.#

**bit6:** 1→Memory is full. 0→Memory is not full.

**bit7:** 1→Auto power off enabled. 0→Auto power off disabled.

**4<sup>th</sup> BYTE:** first two BCD code of T1 value.

**5<sup>th</sup> BYTE:** last two BCD code of T1 value

**6<sup>th</sup> BYTE:**

If bit3 of 2<sup>nd</sup> BYTE =0 : first two BCD code of T1-T2 value.

If bit3 of 2<sup>nd</sup> BYTE =1 : two BCD code of month.

**7<sup>th</sup> BYTE:**

If bit3 of 2<sup>nd</sup> BYTE =0 : last two BCD code of T1-T2 value.

If bit3 of 2<sup>nd</sup> BYTE =1 : two BCD code of day.

**8<sup>th</sup> BYTE:**

If bit3 of 2<sup>nd</sup> BYTE =0 : first two BCD code of T2 value.

If bit3 of 2<sup>nd</sup> BYTE =1 : two BCD code of hour.

**9<sup>th</sup> BYTE:**

If bit3 of 2<sup>nd</sup> BYTE =0 : last two BCD code of T2 value.

If bit3 of 2<sup>nd</sup> BYTE =1 : two BCD code of minute.

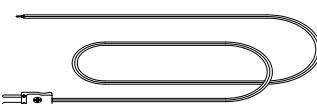
**10<sup>th</sup> BYTE:** end byte, its value is 3, 1<sup>nd</sup> and 10<sup>th</sup> are used to check frame error.

**Appendix: Thermocouple probe specification**

| Model                | Range                            | Tolerances                             | Description  |
|----------------------|----------------------------------|--|--|
| TP-K01<br>Bead probe | -50°C to 200°C<br>-58°F to 392°F | ±2.2°C or ±0.75%<br>(±3.6°F or ±0.75%) | with Teflon tape insulation Maximum insulating temperature : 260°C |

**TP-K01:**

probe for general purpose measurements, especially for complex and hard to reach places.



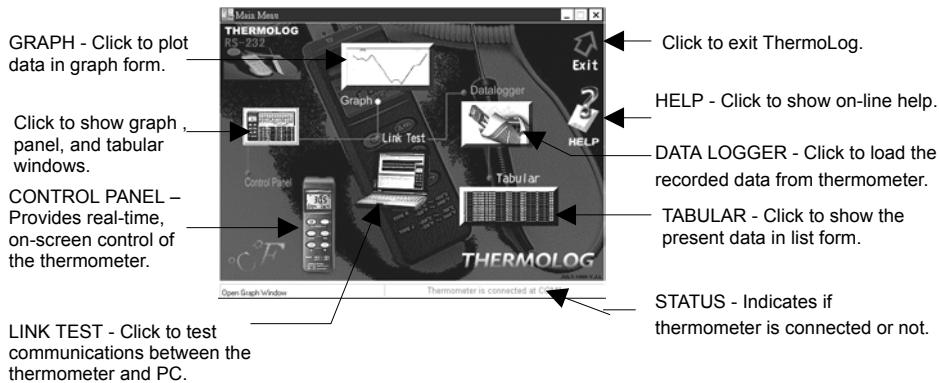
## V. Setup ThermoLog (Thermo DataLogger)—RS232 interface software:

- **The ThermoLog package contains:**
  1. Two 3.5" diskettes
  2. Custom designed RS232 cable for THERMOLOG.
- **System Required:**

Windows 95, Windows 98, Windows NT 4.0, or above.
- **Minimum Hardware Required:**
  - 486-100 MHz PC-compatible, 16 MB RAM
  - At least 5 MB of hard disk space available to install THERMOLOG program
  - Display resolution of 800X600 recommended
- **Install ThermoLog:**
  1. We strongly recommend closing all other applications before installing ThermoLog software.
  2. Insert setup diskette 1 into floppy disk drive.
  3. Choose the Start button on the Taskbar and select Run.
  4. Type A:\SETUP and choose OK. The ThermoLog.exe ( executable file ) and help files will be copied to your hard disk (default location is c:\program files\ThermoLog ).

For other operating instructions, please refer to the on-line help available under ThermoLog.

### Main Menu



#### Link Test :

Open the Link Test window to search for a thermometer connected to the PC. When you start the THERMOLINK program, this window displays first and will automatically search for a thermometer. The result will be shown in the a box.

#### Control Panel:

Open the Control Panel Window to control the thermometer via the buttons in this window.

**DataLogger:**

Open the DataLogger Window to load the recorded data from thermometer to the PC.

**Tabular:**

Open the Tabular window to list the data from the thermometer in a scrolling table. The data can be stored as a file, or the table can be copied to other programs such as Microsoft EXCEL for further analysis.

**Graph:**

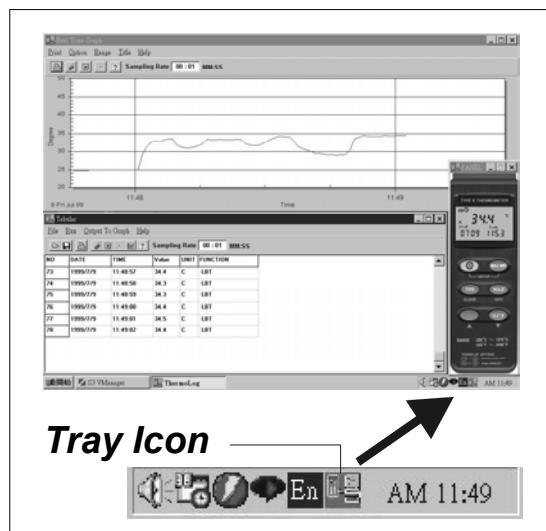
Open the Real-Time Graph window to plot the data in graph form.

**Exit:**

Terminates THERMOLOG program.

**Tray Icon:**

When THERMOLOG is running, there will be an icon displayed on the Windows Tray area (see figure below). Click this icon to open a pop-up menu.





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